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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/532,649	10/12/2005	Bin Liu	3248-6977US (R5/1145 PK/r	4382
24247	7590	02/17/2009	EXAMINER	
TRASK BRITT P.O. BOX 2550 SALT LAKE CITY, UT 84110			HEINCER, LIAM J	
			ART UNIT	PAPER NUMBER
			1796	
			NOTIFICATION DATE	DELIVERY MODE
			02/17/2009	ELECTRONIC

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## **DETAILED ACTION**

### ***Claim Objections***

Claims 1, 32, 66, and 67 are objected to because of the following informalities: Claims 1, 32, 66, and 67 include the limitations "(C3 to C10) cycloalkyl groups". The presence of the parenthesis can imply that the C3 to C10 is not a required element of the claim. Appropriate correction is required.

Claims 49-53 are objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. Claim 49 provides a definition for A, B, E and F that does not fall within the scope defined by claim 1 from which it depends. Claim 49 defines one of A, B, E, and F as being a tetravalent nitrogen group, which is not one of the possible groups defined in claim 1. For the purpose of further examination, claim 49 is being interpreted as being an independent claim with the scope of A, B, E, and F being as defined in claim 49.

### ***Claim Rejections - 35 USC § 112***

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claim 66 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Claim 66 does not require one of the phenylene units (unit a) to have both a C-R<sub>5</sub>-E and a D-R<sub>6</sub>-F group. There is not support in the original specification for a structure with phenylene units absent these groups.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 48-53 and 60-63 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Considering Claims 48-53: Claim 48 recites the limitation "R'" in line 2. There is insufficient antecedent basis for this limitation in the claim.

Considering Claims 60-63: Claim 60 depends from claim 32. However, Claim 60 appears to provide a completely distinct method of making a conjugated cationic polymer than claim 32. Claim 60 provides a method of polymerizing quaternized monomers, while claim 32 provides a method of quaternizing a fully formed polymer. Since the method of claim 60 depends from claim 32 it is not clear if the method of claim 32 further comprises the steps of claim 60 or if claim 60 is a distinct process that should be treated as an independent claim. For the purpose of further examination claim 60 is being treated as an independent claim.

### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

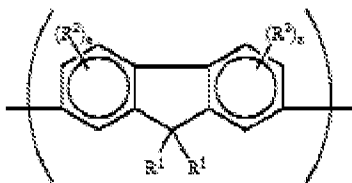
A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1, 2, 5, 11-15, and 21 are rejected under 35 U.S.C. 102(b) as being anticipated by Woo et al. (US 2001/0053842).

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Considering Claims 1, 2, 13, 14, and 21: Woo et al. teaches a polymer of the formula



, where  $R^1$  is a  $C_{1-20}$  hydrocarbyl containing heteroatoms (Claim 1). This represents the formula of claim 1, where  $y=0$  and one of E and F is  $NR'R''$ .

Considering Claim 5: Woo et al. teaches a as being zero (Claim 1).

Considering Claims 11, 12, and 15: When  $y=0$ , the nature of the variables in the phenylene unit do not affect patentability.

### ***Claim Rejections - 35 USC § 103***

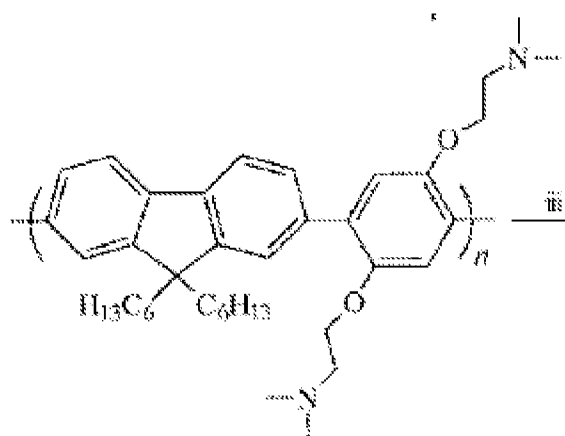
The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1, 3-5, and 7-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liu et al. (Chem Commun, 2000, 551-552) in view of Rau et al. (Acta Polymer, 45, 3-13, 1994) and Huang et al. (US 2002/0013451).

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Considering Claims 1, 4, 5, 7-15, and 19: Liu et al. teaches a polymer of the formula



Liu et al. does not teach the fluorene as having alkyl chains comprising a heteroatom. However, Huang et al. teaches a substituted fluorene-phenylene copolymer with alkoxy substituents (¶0026). Liu et al. and Huang et al. are combinable as they are concerned with the same field of endeavor, namely fluorene-phenylene copolymers. It would have been obvious to a person having ordinary skill in the art at the time of invention to have used the alkoxy substituents of Huang et al. in the place of the alkyl substituents of Liu et al., and the motivation to do so would have been, as Huang et al. suggests, to control the solubility and electronic tenability of the polymer (¶0026).

Liu et al. does not teach the phenylene side chain as having both a heteroatom and an aromatic group. However, Rau et al. teaches using a phenoxy group in the side chain of a functionalized polyphenylene (page 4). Liu et al. and Rau et al. are combinable as they are concerned with the same field of endeavor, namely polyphenylenes with functionalized side chains. It would have been obvious to a person having ordinary skill in the art at the time of invention to have used the phenoxy groups of Rau et al. in the polymer of Liu et al., and the motivation to do so would have been, as Rau et al. suggests, to improve the solubility of the polymer (page 3).

Considering Claims 3, 20, and 21: Liu et al. does not teach the polymer as being random. However, due to the close structural similarity between the disclosed polymer and the claimed polymer a person having ordinary skill in the art at the time of invention

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would have expected them to possess similar properties. Thus the claimed structure is prima facie obvious in view of the prior art structure. See MPEP § 2144.09.

Considering Claim 16: Liu et al. teaches a weight average molecular weight of 47000 and a polydispersity of 1.61 (page 551). Based on a molecular weight of ~570 per repeat unit there would be approximately 51 repeat units per polymer. Since this is the average number of units, there would implicitly be polymers with less than this number of units/1 to 50.

Considering Claim 17: Liu et al. is silent as to an endcapping reaction. Therefore one could reasonably assume that the end units comprise one of each monomer type/an aryl moiety containing a halogen and a boronate radical.

Considering Claim 18: Liu et al. does not teach endcapping. However, Huang et al. teaches endcapping a fluorene-phenylene polymer with aryl groups (¶0030). It would have been obvious to a person having ordinary skill in the art at the time of invention to have endcapped the polymer of Liu et al. with the aryl groups of Huang et al., and the motivation to do so would have been, as Huang et al. suggests, to end the reaction at the desired molecular weight (¶0030).

Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Liu et al. (Chem Commun, 2000, 551-552) in view of Rau et al. (Acta Polymer, 45, 3-13, 1994) and Huang et al. (US 2002/0013451) as applied to claim 1 above, and further in view of Woo et al. (WO 99/54385).

Considering Claim 6: Liu et al., Rau et al., and Huang et al. collectively teach the polymer of claim 1 as shown above.

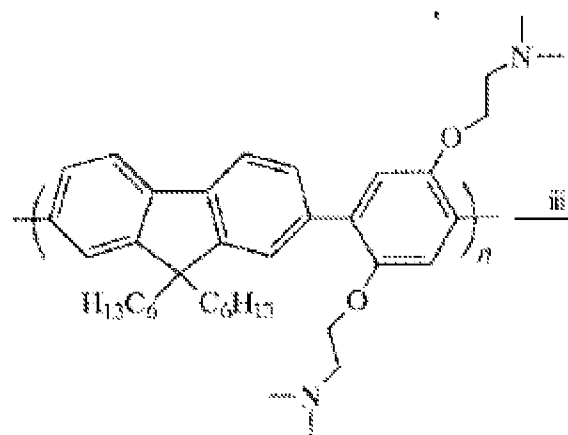
Liu et al. does not teach the fluorene as being additionally substituted. However, Woo et al. teaches including alkoxy groups with 1 to 4 carbon atoms on a fluorene polymer (3:10-14). Liu et al. and Woo et al. are combinable as they are concerned with the same field of endeavor, namely fluorene polymers. It would have been obvious to a person having ordinary skill in the art at the time of invention to have used the alkoxy groups of Woo et al. in the polymer of Liu et al. and the motivation to do so would have

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been, as Woo et al. suggests, it is equivalent to the hydrogen atoms presented in Liu et al. (3:10-14).

Claims 32-39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liu et al. (Chem Commun, 2000, 551-552) in view of Rau et al. (Acta Polymer, 45, 3-13, 1994) and Huang et al. (US 2002/0013451).

Considering Claim 32: Liu et al. teaches providing a polymer of the formula



(page 551); and quaternizing the terminal amino groups (page 551). : Liu et al. also teaches a weight average molecular weight of 47000 and a polydispersity of 1.61 (page 551). Based on a molecular weight of ~570 per repeat unit there would be approximately 51 repeat units per polymer. Additionally, Liu et al. is silent as to an endcapping reaction. Therefore one could reasonably assume that the end units comprise one of each monomer type/an aryl moiety containing a halogen and a borane radical.

Liu et al. does not teach the fluorene as having alkyl chains comprising a heteroatom. However, Huang et al. teaches a substituted fluorene-phenylene copolymer with alkoxy substituents (¶0026). Liu et al. and Huang et al. are combinable as they are concerned with the same field of endeavor, namely fluorene-phenylene copolymers. It would have been obvious to a person having ordinary skill in the art at the time of invention to have used the alkoxy substituents of Huang et al. in the place of the alkyl substituents of Liu et al., and the motivation to do so would have been, as



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Huang et al. suggests, to control the solubility and electronic tenability of the polymer (¶0026).

Liu et al. does not teach the phenylene side chain as having both a heteroatom and an aromatic group. However, Rau et al. teaches using a phenoxy group in the side chain of a functionalized polyphenylene (page 4). Liu et al. and Rau et al. are combinable as they are concerned with the same field of endeavor, namely polyphenylenes with functionalized side chains. It would have been obvious to a person having ordinary skill in the art at the time of invention to have used the phenoxy groups of Rau et al. in the polymer of Liu et al., and the motivation to do so would have been, as Rau et al. suggests, to improve the solubility of the polymer (page 3).

Considering Claim 33: Liu et al. teaches the highest degree of quaternization obtained as being 80% (page 552).

Considering Claims 34-39: Liu et al. teaches stirring the polymer with bromoethane in DMSO and THF in a ratio of 1:4 at about 50 °C for 3 days/about 1 or 5 days (page 551).

Claims 40-42 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liu et al. (Chem Commun, 2000, 551-552) in view of Rau et al. (Acta Polymer, 45, 3-13, 1994) and Huang et al. (US 2002/0013451) as applied to claim 36 above, and further in view of Ho et al. (WO 00/60612).

Considering Claims 40-42: Liu et al., Rau et al., and Huang et al. collectively teach the method of claim 36 as shown above. Additionally, during the conversion treatment of the polymer, at least a portion of the DMSO and THF would inherently evaporate.

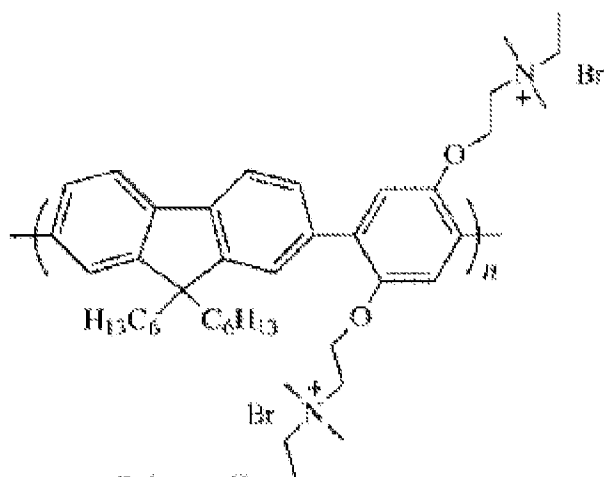
Liu et al. does not teach the polymer as being precipitated and washed. However, Ho et al. teaches precipitating a fluorene polymer in acetone, centrifuging the precipitate and washing the polymer with chloroform (page 20). Liu et al. and Ho et al. are combinable as they are concerned with the same field of endeavor, namely fluorene copolymers. It would have been obvious to a person having ordinary skill in the art at the time of invention to have used the purification steps of Ho et al. in the process of Liu et al., and the motivation to do so would have been, as Ho et al. suggests, to purify the polymer (page 20).

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Liu et al. does not teach drying the polymer. However, Huang et al. teaches drying a fluorene polymer ( $\P$ 0030). It would have been obvious to a person having ordinary skill in the art at the time of invention to have dried the polymer of Liu et al. as in Huang et al., and the motivation to do so would have been, as Huang et al. suggests, to remove residual solvent from the polymer ( $\P$ 0030).

Claim 47-53, 64, and 65 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liu et al. (Chem Commun, 2000, 551-552) in view of Rau et al. (Acta Polymer, 45, 3-13, 1994) and Huang et al. (US 2002/0013451).

Considering Claims 47, 49, 50-52, and 64: Liu et al. teaches a polymer of the formula



Polymer II

(page 551).

Liu et al. does not teach the fluorene as having alkyl chains comprising a heteroatom. However, Huang et al. teaches a substituted fluorene-phenylene copolymer with alkoxy substituents ( $\P$ 0026). Liu et al. and Huang et al. are combinable as they are concerned with the same field of endeavor, namely fluorene-phenylene copolymers. It would have been obvious to a person having ordinary skill in the art at the time of invention to have used the alkoxy substituents of Huang et al. in the place of the alkyl substituents of Liu et al., and the motivation to do so would have been, as Huang et al. suggests, to control the solubility and electronic tenability of the polymer ( $\P$ 0026).

Liu et al. does not teach the phenylene side chain as having both a heteroatom and an aromatic group. However, Rau et al. teaches using a phenoxy group in the side chain of a functionalized polyphenylene (page 4). Liu et al. and Rau et al. are combinable as they are concerned with the same field of endeavor, namely polyphenylenes with functionalized side chains. It would have been obvious to a person having ordinary skill in the art at the time of invention to have used the phenoxy groups of Rau et al. in the polymer of Liu et al., and the motivation to do so would have been, as Rau et al. suggests, to improve the solubility of the polymer (page 3).

Considering Claim 48: Liu et al. does not teach the one of the R groups as being hydrogen. However, due to the close structural similarity between the disclosed polymer and the claimed polymer a person having ordinary skill in the art at the time of invention would have expected them to possess similar properties. Thus the claimed structure is prima facie obvious in view of the prior art structure. See MPEP § 2144.09.  
Considering Claim 53: Liu et al. teaches the highest degree of quaternization obtained as being 80% (page 552).

Liu et al. does not teach the quaternization degree as being from 30 to 60%. However, it is well known in the art to optimize result effective variables such as quaternization degree. It would have been obvious to a person having ordinary skill in the art at the time of invention to have optimized the degree of quaternization through routine optimization, and the motivation to do so would have been, as Liu et al. suggests, to control the water solubility of the polymer (page 551). See MPEP § 2144.05.

Considering Claim 65: Liu et al. is concerned with the solubility of the polymer (page 551). Therefore a person having ordinary skill in the art at the time of invention would necessarily calculate the desired solubility and tailor the production to give this solubility.

Claims 60-63 rejected under 35 U.S.C. 103(a) as being unpatentable over Liu et al. (Chem Commun, 2000, 551-552).

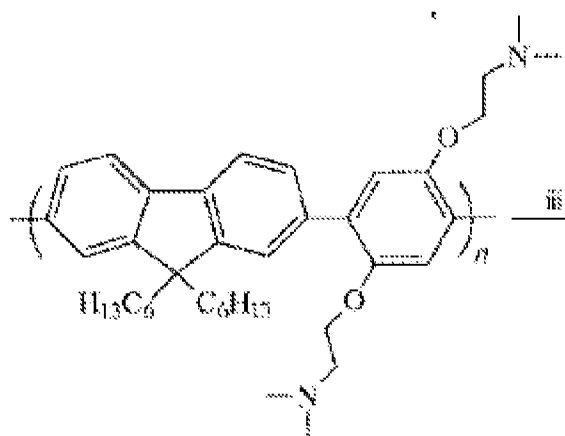
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Considering Claims 60 and 61: Liu et al. teaches a method comprising providing monomers with terminal amino groups; synthesizing a conjugated polymer through Suzuki coupling; and quaternizing the terminal amino groups (page 551). While Liu et al. does not explicitly disclose quaternizing the terminal amino groups prior to the polymerization, Liu et al. does discuss the advantages of the post-polymerization versus pre-polymerization quaternization (page 551). Therefore, Liu et al. implicitly discloses a method of quaternizing the amino groups prior to polymerization.

Considering Claims 62 and 63: Liu et al. is concerned with the solubility of the polymer (page 551). Therefore a person having ordinary skill in the art at the time of invention would necessarily calculate the desired solubility and tailor the production to give this solubility.

Claim 66 is rejected under 35 U.S.C. 103(a) as being unpatentable over Liu et al. (Chem Commun, 2000, 551-552) in view of Rau et al. (Acta Polymer, 45, 3-13, 1994) and Huang et al. (US 2002/0013451).

Considering Claim 66: Liu et al. teaches a polymer of the formula



Liu et al. does not teach the fluorene as having alkyl chains comprising a heteroatom. However, Huang et al. teaches a substituted fluorene-phenylene copolymer with alkoxy substituents (¶0026). Liu et al. and Huang et al. are combinable as they are concerned with the same field of endeavor, namely fluorene-phenylene copolymers. It would have been obvious to a person having ordinary skill in the art at

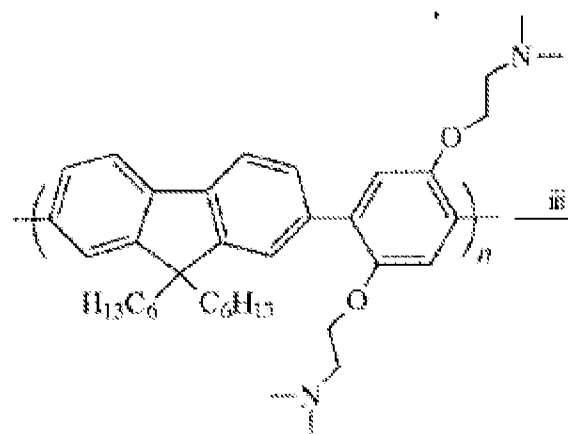
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the time of invention to have used the alkoxy substituents of Huang et al. in the place of the alkyl substituents of Liu et al., and the motivation to do so would have been, as Huang et al. suggests, to control the solubility and electronic tenability of the polymer ( $\P$ 0026).

Liu et al. does not teach the phenylene side chain as having both a heteroatom and an aromatic group. However, Rau et al. teaches using a phenoxy group in the side chain of a functionalized polyphenylene (page 4). Liu et al. and Rau et al. are combinable as they are concerned with the same field of endeavor, namely polyphenylenes with functionalized side chains. It would have been obvious to a person having ordinary skill in the art at the time of invention to have used the phenoxy groups of Rau et al. in the polymer of Liu et al., and the motivation to do so would have been, as Rau et al. suggests, to improve the solubility of the polymer (page 3).

Claim 67 is rejected under 35 U.S.C. 103(a) as being unpatentable over Liu et al. (Chem Commun, 2000, 551-552) in view of Rau et al. (Acta Polymer, 45, 3-13, 1994) and Huang et al. (US 2002/0013451).

Considering Claim 67: Liu et al. teaches a polymer of the formula



(page 551).

Liu et al. does not teach the fluorene as having alkyl chains comprising a heteroatom. However, Huang et al. teaches a substituted fluorene-phenylene copolymer with alkoxy substituents ( $\P$ 0026). Liu et al. and Huang et al. are combinable as they are concerned with the same field of endeavor, namely fluorene-phenylene

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copolymers. It would have been obvious to a person having ordinary skill in the art at the time of invention to have used the alkoxy substituents of Huang et al. in the place of the alkyl substituents of Liu et al., and the motivation to do so would have been, as Huang et al. suggests, to control the solubility and electronic tenability of the polymer (¶0026).

Liu et al. does not teach the phenylene side chain as having both a heteroatom and an aromatic group. However, Rau et al. teaches using a phenoxy group in the side chain of a functionalized polyphenylene (page 4). Liu et al. and Rau et al. are combinable as they are concerned with the same field of endeavor, namely polyphenylenes with functionalized side chains. It would have been obvious to a person having ordinary skill in the art at the time of invention to have used the phenoxy groups of Rau et al. in the polymer of Liu et al., and the motivation to do so would have been, as Rau et al. suggests, to improve the solubility of the polymer (page 3).

### ***Double Patenting***

Applicant is advised that should claim 1 be found allowable, claim 67 will be objected to under 37 CFR 1.75 as being a substantial duplicate thereof. When two claims in an application are duplicates or else are so close in content that they both cover the same thing, despite a slight difference in wording, it is proper after allowing one claim to object to the other as being a substantial duplicate of the allowed claim. See MPEP § 706.03(k).

### ***Response to Arguments***

Applicant's arguments filed December 16, 2008 have been fully considered but they are not persuasive, because:

A) Applicants argument that Huang et al. teaches away from using alkoxy groups at the 9 position of the fluorene ring is not persuasive. While Huang et al. teaches alkyl groups as the preferred group this is not the same as teaching way from using other groups in the disclosed list. A reference may be relied upon for all that it would have reasonably suggested to one having ordinary skill the art, including nonpreferred

embodiments. *Merck & Co. v. Biocraft Laboratories*, 874 F.2d 804, 10 USPQ2d 1843 (Fed. Cir.), *cert. denied*, 493 U.S. 975 (1989). See MPEP § 2123. As Huang et al. teaches that altering the group attached 9 position of the fluorene will affect the solubility and tunability of the polymer, a person having ordinary skill in the art at the time of invention would have been motivated to use any of the disclosed groups to achieve the desired properties.

B) Applicants argument that list of Huang et al. is not finite is not persuasive. There are six genres disclosed in the structure of Huang et al., two of which have the required heteroatom (Claim 1). It would have been well within the skill of a person having ordinary skill in the art at the time of invention to screen six genres in order to find the desired solubility and tunability.

Additionally, when the species is clearly named, the species claim is anticipated no matter how many other species are additionally named. *Ex parte A*, 17 USPQ2d 1716 (Bd. Pat. App. & Inter. 1990). See MPEP 2131.02. As the reference explicitly teaches the claimed substituent, the number of other substituents is not germane.

### **Conclusion**

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

***Correspondence***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Liam J. Heincer whose telephone number is 571-270-3297. The examiner can normally be reached on Monday thru Friday 7:30 to 5:00 EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Eashoo can be reached on 571-272-1197. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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/Mark Eashoo/  
Supervisory Patent Examiner, Art Unit 1796

LJH  
February 4, 2009